DETAILED DESCRIPTION OF THE INVENTION

[0034] Embodiments of the invention are now described in detail. Referring to the drawings, like numbers indicate like parts throughout the views. The apparatus components have been represented where appropriate by conventional symbols in the drawings, showing only those specific details that are pertinent to understanding the embodiments of the present invention so as not to obscure the disclosure with details that will be readily apparent to those of ordinary skill in the art having the benefit of the description herein.

[0035] As used in the description herein and throughout the claims, the following terms take the meanings explicitly associated herein, unless the context clearly dictates otherwise: the meaning of "a," "an," and "the" includes plural reference, the meaning of "in" includes "in" and "on." Relational terms such as first and second, top and bottom, and the like may be used solely to distinguish one entity or action from another entity or action without necessarily requiring or implying any actual such relationship or order between such entities or actions. Also, reference designators shown herein in parenthesis indicate components shown in a figure other than the one in discussion. For example, talking about a device (**100**) while discussing figure A would refer to an element, **100**, shown in figure other than figure A.

[0036] It will be appreciated by those of ordinary skill in the art having the benefit of this disclosure that embodiments of the invention described herein may be comprised of one or more conventional processors and unique stored firmware or software program instructions that control the one or more processors to implement, in conjunction with certain non-processor circuits, some, most, or all of the functions of a mode-based user interface. The non-processor circuits may include, but are not limited to, a radio receiver, a radio transmitter, signal drivers, clock circuits, power source circuits, and user input devices. Further, it is expected that one of ordinary skill, notwithstanding possibly significant effort and many design choices motivated by, for example, available time, current technology, and economic considerations, when guided by the concepts and principles disclosed herein will be readily capable of generating such software or firmware instructions and programs, as well as the non-processor circuits, with minimal experimentation.

[0037] A portable electronic device, such as a mobile telephone, includes a user interface for receiving a touch input. The user interface includes a cover layer, which may be plastic or glass, for protecting the interface. A capacitive sensor layer is disposed beneath the cover layer. The capacitive sensor layer, in one embodiment, is configured to be a "proximity detector" to detect the presence of an object, such as a user's finger, near to or touching the user interface. The capacitive sensor layer may optionally be configured to determine the location of an object along the device as well.

[0038] A segmented optical shutter layer, which in one embodiment is a low-resolution, twisted nematic liquid crystal display, is disposed beneath the cover layer and is configured to present multiple interface configurations to a user. By opening and closing geometrically specific "shutters", the optical shutter layer may present a plurality of mode-base user interfaces or keypad configurations along a keypad region of the device. The shutters in the low-resolution display comprise selectively operable segments that are configured to transition between an opaque state and a translucent state, thereby revealing and hiding user actuation targets. In one embodiment, the user actuation targets are each geometrically configured as one of alphanumeric keys, predetermined symbol keys, or device navigation controls. Examples of predetermined symbol keys include a photo capture key, a call send key, a call end key, a play key, a record key, a pause key, a forward key, and a reverse key.

[0039] Embodiments of the present invention provide a dynamic keypad interface capable of selectively presenting, and optionally actively illuminating, various keypad configurations to simplify the overall user input of the device. In one embodiment, the keypad configurations are limited to only the keys necessary for either the current mode of operation or for navigation between the multiple modes. The optical shutter layer opens shutters to either reflect incident light in a transflective mode, to provide a high-resolution keypad in bright-light environments, or by way of electroluminescent layer project light through the shutter openings, to provide a high-resolution keypad in low-light environments. Electrical impulses, which are applied to specially shaped, translucent electrodes, enable key graphics or icons to be selectively opened or closed, i.e. turned on or off, to match the operating mode of the device.

[0040] Some configurations of the present device are configured to present navigations controls to the user. The navigation controls, which in one embodiment include a scroll wheel centrally disposed within a keypad region of the device, allow a user to navigate between objects or records in a single mode. Alternatively, the navigation controls allow the user to also navigate between the various modes of the device. In one particular configuration, to assist the user in operating the device, the navigation controls are presented in the same location regardless of the operational mode of the device.

[0041] In one embodiment, the cover layer comprises a layer of thin film plastic. By using such a cover layer, embodiments of the invention enable both a dynamic user interface and a seamless industrial design form factor. The user interface, which is substantially planar in one embodiment, provides a selectively unobstructed, smooth keypad surface.

[0042] When the optical shutter device is in the off state, in one embodiment, it is in an opaque state. The optical shutter therefore prohibits light from being transmitted into, or out of, the device. This results in visually masking the various layers of the user interface disposed below the optical shutter. In the inactive state, the optical shutter creates a uniformed colored surface across the face of the device. In one embodiment, the exterior housing of the device is chosen to match the color of the optical shutter in the off state. As such, when the optical shutter is off, the user interface appears to be a blank surface having the same color as the housing.

[0043] In one embodiment, the optical shutter is disposed not only atop the keypad region, but also atop the display region and a corresponding high resolution display. This particular construction visually hides the high-resolution display when the device is OFF or in a low power mode. Slots and gaps are not required in the user interface of the present invention because an electrical switch layer configured to sense key actuation requires only a small deflection of the cover layer (~40 um). Further, some force sensing technologies may require virtually no deflection at all—only changes in pressure. As such, the traditional keypad mechanical dome, or "popple", which requires tenths of millimeters of travel for actuation, is not required. The result is a smooth, seamless user interface without protrusions or indentations. In one embodiment, a tactile feedback mechanism is included to inform the user when a key is actuated.